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# Craniofacial anthropometric norms of Malays

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## ABSTRACT

**Introduction: This study was undertaken to establish the craniofacial anthropometric norms of young adult Malaysian Malays.**

**Methods: The study group consisted of convenient samples of 100 healthy volunteers (aged 18–25 years), with an equal number of female and male subjects who had no history of mixed racial parentage. 22 linear measurements were taken twice from 22 landmarks over six craniofacial regions.**

**Results: The Malays shared many similar sizes of measurements with the Singaporean Chinese. Their left eye fissure length and mouth width (ch-ch) were almost identical for both genders. However, Malay females had an upper lip height (sn-sto) (left) and ear width (pra-pa) similar to Singaporean Chinese females. Six other measurements, viz. the head width (eu-eu), head circumference (on-op), face height (n-gn), lower face height (sn-gn), (left) eye fissure height (ps-pi), cutaneous upper lip height (sn-ls) and cutaneous upper lip height (ls-sto), were 0.4–4.3 mm less in the Malays. Measurements for another four parameters, viz. the length of the head (g-op), biocular width (ex-ex), lower vermillion height (sto-li) and (left) ear length (sa-sba), were 0.5–3.6 mm higher in the Malays. Only three measurements were obviously different; the height of the head (v-n) and intercanthal width (en-en), were lower, and the protrusion of the nasal tip (sn-prn) was higher in the Malays.**

**Conclusion: These findings suggest that three features, i.e. the height of the head (v-n), intercanthal width (en-en) and protrusion of the nasal tip (sn-prn) may be useful in differentiating a Malay face from a Singaporean Chinese one.**


**Keywords: anthropometry, craniofacial anthropometric norms, face, facial features**

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## INTRODUCTION

Anthropometry is the measurement of living subjects.[1] It has been shown to be useful in orthodontic research[2] and in reconstructive surgery, where the soft tissue morphology of the face can be studied more reliably than comparisons from radiographs.[3] Anthropometric measurements of the head and face can be used together with cephalometry, computed tomography (CT) and magnetic resonance (MR) imaging in preparation for a patient undergoing plastic and reconstructive surgery.[3] This study seeks to expand scientific research to create hands-on value for surgeons treating the Malays, who mainly reside in Malaysia, Singapore, Brunei, Thailand and the Indonesian archipelago. Together, they make up about 250 million of the world population. This study addresses a current void, i.e. the lack of a specific anthropometric study on the craniofacial complex of Malays. All this while, Southeast Asian plastic and reconstructive surgeons, head and neck surgeons, oral and maxillofacial surgeons, orthodontists, forensic investigators and other practitioners have not had any baseline anthropometric templates for the craniofacial complex of the Malays, referring instead to subjective visual "landmark" comparisons as their main tool. Using established anthropometric craniofacial measurement techniques to find universal craniofacial focal points, this study's primary intention was to establish a baseline quantitative data of the Malays.

## METHODS

The study group consisted of a convenient sample of 100 young adult Malays, with an equal number of female and male subjects. Their age ranged from 18 to 25 years. The participants chosen were generally healthy and exhibited no craniofacial abnormalities acquired either through road traffic accidents or other forms of trauma, congenital or developmental discrepancies and had no history of having undergone plastic or reconstructive surgery. Subjects of mixed parentage were excluded from this study. The data was collected between June and December 2004. Standard anthropometric instruments were used in this study. They were the Mitutoyo digital sliding calliper (Mitutoyo Corp, Kawasaki, Japan), spreading calliper, measuring tape and a modified sliding calliper with bubble levels.

**Table I. Definitions of measurements using various landmarks on the head, face, orbit, nose orolabial and ear.**

| No. | Landmark | Region and measurement definition |
|---|---|---|
| | | Head |
| 1 | (eu-eu) | Width of the head |
| 2 | (g-op) | Length of the head |
| 3 | (v-n) | Height of the head |
| 4 | (on-op) | Head circumference |
| | | Face |
| 5 | (zy-zy) | Face width |
| 6 | (n-gn) | Face height |
| 7 | (n-sto) | Upper face height |
| 8 | (sn-gn) | Lower face height |
| | | Orbit |
| 9 | (en-en) | Intercanthal width |
| 10 | (ex-ex) | Biocular width |
| 11 | (ex-en) | (left) Eye fissure length |
| 12 | (ps-pi) | (left) Eye fissure height |
| | | Nose |
| 13 | (n-sn) | Nose height |
| 14 | (al-al) | Nose width |
| 15 | (sn-prn) | Protrusion of the nasal tip |
| | | Orolabial |
| 16 | (ch-ch) | Mouth width |
| 17 | (sn-sto) | Upper lip height |
| 18 | (sn-ls) | Cutaneous upper lip height |
| 19 | (ls-sto) | Upper vermillion height |
| 20 | (sto-li) | Lower vermillion height |
| | | Ear |
| 21 | (pra-pa) | (left) Ear width |
| 22 | (sa-sba) | (left) Ear length |

22 linear measurements were taken from 22 landmarks over six craniofacial regions. Every measurement was taken twice by the same examiner and recorded in the corresponding form. A third reading was taken if the initial two measurements showed a large discrepancy, and the two closer readings would then be used. This methodology and evaluation of the craniofacial region was adapted from Hajnis et al.[4] To avoid errors in locating landmarks that were used for more than one measurement (e.g. nasion, subnasale), these landmarks were marked on the skin.

The landmarks used in this study are standard landmarks used in craniofacial anthropometric studies, viz:

- vertex (v), glabella (g) or nasal eminence, opisthocranium (op), ophyron (on) and euryon (eu) on the head,
- zygion (zy), nasion (n), subnasale (sn), stomion (sto) and gnathion (gn) or menton on the face,
- endocanthion (en), exocanthion (ex), palpebrale superius (ps) and palpebrale inferius (pi) on the eye,
- alare (al) and pronasale (prn) on the nose,
- cheilion (ch), labiale (or labrale) superius (ls) and labiale (or labrale) inferius (li) on the orolabial region,
- superaurale (sa), subaurale (sba), preaurale (pra), postaurale (pa) on the ear.

The head, facial, orbital, nasal, orolabial and ear measurements were derived from the measurements using these landmarks. The measurement definitions are shown in Table I. Data was analysed using the Statistical Package for Social Sciences version 11.0 (SPSS Inc, Chicago, IL, USA). An independent *t*-test was performed to evaluate if there was any significant difference in the measurement between the genders. A p-value of $< 0.05$ was set as being statistically significant.

## RESULTS

The craniofacial anthropometric norms of the Malays are shown in Table II. In general, it can be noted that the minimum measurements are always contributed by the female Malays, except for the lower width of the face (zy-zy), nose height (n-sn) and mouth width (ch-ch) measurements in the males. A p-value of $< 0.05$ was noted in all measurements except for the (left) eye fissure height (ps-psi); hence the differences noted between the genders were significant except for the (left) eye fissure height (ps-psi).

## DISCUSSION

Racial and ethnic differences in the facial traits of American and European Caucasian, Afro-American, Turkish, Arabians and Chinese have been reported by several authors.[3,5-8] Although the differences may be small, a combination of these linear and angular measurements produces the variations seen in different population groups. In the only comprehensive comparison study on Asian facial features, Farkas provided a detailed description of the differences between Singaporean Chinese facial features and the North American White and African American ones.[3] More recently, Farkas et al have published an international anthropometric study of the facial morphology of 26 ethnic groups/races throughout the world, which include five Asian ethnic groups.[9] Nevertheless, it is important to note that, to date, no detailed research of this kind has been conducted or published for the Malay ethnic group.

As there was no previous data on the Malays that was available for comparison, the authors undertook the task of comparing their findings with Farkas' data on the Singaporean Chinese young adult. The Singaporean Chinese were chosen instead of the North American Whites (which was routinely done by Farkas) based on the anthropological origins of both the Malays and Chinese as Mongoloids. Moreover, of the currently available data on Asian samples, the data on the Singaporean Chinese is

**Table II. Craniofacial anthropometric norms of the head, face, orbit, nose orolabial and ear of the Malays.**

| Landmark | Mean ± SD (mm) | Range (mm) | p-value* |
|---|---|---|---|
| (eu-eu) | | | 0.000 |
| Male | 155.0 ± 5.9 | 138.0–163.0 | |
| Female | 149.4 ± 5.7 | 132.0–159.0 | |
| Combined | 152.2 ± 6.4 | | |
| (g-op) | | | 0.000 |
| Male | 184.1 ± 6.7 | 170.0–197.0 | |
| Female | 173.4 ± 6.0 | 162.0–186.0 | |
| Combined | 178.7 ± 8.3 | | |
| (v-n) | | | 0.000 |
| Male | 104.4 ± 8.4 | 85.0–121.0 | |
| Female | 94.8 ± 6.5 | 79.0–108.0 | |
| Combined | 99.6 ± 8.9 | | |
| (on-op) | | | 0.000 |
| Male | 556.6 ± 16.6 | 519.0–605.0 | |
| Female | 534.9 ± 15.9 | 505.0–569.0 | |
| Combined | 545.7 ± 19.5 | | |
| (zy-zy) | | | 0.000 |
| Male | 132.5 ± 7.0 | 121.0–153.0 | |
| Female | 140.1 ± 4.9 | 123.0–142.0 | |
| Combined | 136.3 ± 7.1 | | |
| (n-gn) | | | 0.000 |
| Male | 119.3 ± 6.2 | 106.3–134.7 | |
| Female | 111.8 ± 5.8 | 93.9–128.9 | |
| Combined | 115.6 ± 7.0 | | |
| (n-sto) | | | 0.000 |
| Male | 76.7 ± 3.5 | 68.1–82.5 | |
| Female | 72.6 ± 3.7 | 64.0–84.0 | |
| Combined | 74.7 ± 4.2 | | |
| (sn-gn) | | | 0.000 |
| Male | 68.5 ± 5.2 | 48.4–82.2 | |
| Female | 63.2 ± 4.7 | 48.4–75.7 | |
| Combined | 65.9 ± 5.6 | | |
| (en-en) | | | 0.007 |
| Male | 33.9 ± 1.9 | 28.0–36.2 | |
| Female | 32.5 ± 1.7 | 26.7–34.6 | |
| Combined | 33.2 ± 2.7 | | |
| (ex-ex) | | | 0.001 |
| Male | 92.3 ± 4.1 | 82.1–101.0 | |
| Female | 89.6 ± 3.2 | 82.8–98.7 | |
| Combined | 90.9 ± 4.0 | | |
| (ex-en) | | | 0.005 |
| Male | 29.5 ± 1.5 | 26.3–32.3 | |
| Female | 28.7 ± 1.4 | 25.4–31.7 | |
| Combined | 26.1 ± 1.5 | | |
| (ps-pi) | | | 0.415 |
| Male | 10.2 ± 1.0 | 8.3–12.9 | |
| Female | 10.0 ± 1.1 | 7.7–12.2 | |
| Combined | 10.1 ± 1.0 | | |
| (n-sn) | | | 0.000 |
| Male | 51.6 ± 3.5 | 44.2–60.5 | |
| Female | 54.1 ± 2.9 | 45.8–57.4 | |
| Combined | 52.9 ± 3.4 | | |
| (al-al) | | | 0.000 |
| Male | 41.0 ± 2.0 | 43.2–46.2 | |
| Female | 37.3 ± 2.6 | 31.1–36.2 | |
| Combined | 39.2 ± 3.0 | | |
| (sn-prn) | | | 0.042 |
| Male | 18.1 ± 1.6 | 15.1–21.8 | |
| Female | 17.5 ± 1.5 | 11.5–20.1 | |
| Combined | 17.8 ± 1.6 | | |
| (ch-ch) | | | 0.016 |
| Male | 48.8 ± 3.5 | 35.7–55.4 | |
| Female | 47.1 ± 3.5 | 40.3–54.3 | |
| Combined | 47.9 ± 3.6 | | |
| (sn-sto) | | | 0.000 |
| Male | 22.7 ± 2.0 | 18.2–29.0 | |
| Female | 21.1 ± 1.9 | 16.0–26.3 | |
| Combined | 21.9 ± 2.1 | | |
| (sn-ls) | | | 0.007 |
| Male | 13.1 ± 1.7 | 8.8–17.1 | |
| Female | 12.2 ± 1.8 | 8.5–17.8 | |
| Combined | 12.7 ± 1.8 | | |
| (ls-sto) | | | 0.003 |
| Male | 9.8 ± 1.1 | 7.4–12.7 | |
| Female | 9.1 ± 1.0 | 7.1–12.0 | |
| Combined | 9.4 ± 1.1 | | |
| (sto-li) | | | 0.001 |
| Male | 12.0 ± 1.6 | 8.8–15.4 | |
| Female | 11.0 ± 1.2 | 8.3–13.4 | |
| Combined | 11.5 ± 1.5 | | |
| (pra-pa) | | | 0.010 |
| Male | 33.4 ± 2.6 | 29.3–43.3 | |
| Female | 32.0 ± 2.1 | 27.0–36.4 | |
| Combined | 32.7 ± 2.7 | | |
| (sa-sba) | | | 0.014 |
| Male | 63.2 ± 3.7 | 55.3–73.6 | |
| Female | 61.2 ± 4.3 | 53.8–72.1 | |
| Combined | 62.2 ± 4.1 | | |

* Independent *t*-test; $p < 0.05$

the most complete, as compared to that of the Japanese, Vietnamese and Thai.[3] Out of 22 measurements around the craniofacial region, the Malay and Singaporean Chinese shared many similar measurements. Their (left) eye fissure length and mouth width (ch-ch) were almost identical for both genders. Besides, the Malay females also had an upper lip height (sn-sto) (left) and ear width (pra-pa) that were similar to those of the Singaporean Chinese females. Measurement of another six parameters, viz. the width of the head (eu-eu), head circumference (on-op), face height (n-gn), lower face height (sn-gn), (left) eye fissure height (ps-pi), cutaneous upper lip height (sn-ls) and cutaneous upper lip height (ls-sto) were slightly lower in the Malays. However, they only manifested differences between 0.4 mm and 4.3 mm. Measurements for another four parameters, viz. the length of the head (g-op), biocular width (ex-ex), lower vermillion height (sto-li) and (left) ear length (sa-sba), were slightly higher in the Malays, with differences between 0.5 mm and 3.6 mm. If the error of the standard deviation (SD) is taken into consideration, then these differences become not significant and the findings can be generalised as being within the same range.

Only three measurements showed obvious differences between the Malays and the Singaporean Chinese, viz. the height of the head (v-n) and intercanthal width (en-en), which were lower, and the protrusion of the nasal tip (sn-prn), which was higher, in the Malays. Specifically, the difference for the height of the head (v-n) was more than 1 cm. These findings suggest that these three features may be useful in diffentiating a Malay face from that

of a Singaporean Chinese. However, more extensive anthropometry study needs to be done to confirm this finding. It has to be noted that no direct statistical study can be conducted between these two groups of data as Farkas' detailed data was not available to the authors. Readers are to note that Farkas' samples were smaller, amounting to only 30 subjects for each gender.

An interesting observation, which can also lead to further study, was the observed gender differences in almost all measurements. Statistical gender comparison from the examined sample demonstrated a larger reading around the craniofacial region in males compared to females. Thus, based on the descriptive comparison, it is interesting to note that the Malays and Chinese shared several features that were either similar or differed only slightly from each other. Perhaps the anthropologist has rightfully classified both the Malays and the Chinese as Mongoloids because of the similarities that are present in certain facial features.

The subjects chosen were of a convenient sample and included students from the various states in Malaysia. However, due to a relatively small sample size, the results obtained in this study may not be representative of the norm for the whole population of Malays. A large prospective study is required to confirm the findings of this study. In conclusion, Malays shared many similar sizes of craniofacial measurements with the Singaporean Chinese. Their (left) eye fissure length and mouth width (ch-ch) were almost identical for both genders. In addition, Malay females had an upper lip height (sn-sto) (left) and ear width (pra-pa) similar to those of Singaporean Chinese females. Three features, viz. the height of the head (v-n), intercanthal width (en-en) and protrusion of the nasal tip (sn-prn), may be useful in differentiating a Malay face from that of a Singaporean Chinese.

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